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Mitchell G. Spiegel

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- ### 3 Electrical proximity sensors

H. Clergeot, D. Placko, J. M. Detriche

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Liebeaux, N.; Le Bihan, Y.; Placko, D.;
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generated by DPSM are compared with those obtained analytically. Good qualitative matching between the two sets of mode shapes is obtained. This analysis shows that when bounded acoustic beams strike a corrugated plate at an angle, the elastic waves can propagate in both forward and backward directions in the waveguide depending on the degree of corrugation. The back propagation of ultrasonic waves in corrugated waveguides for large corrugation depth is reported for the first time in this paper.

ACKNOWLEDGMENTS

The authors thank Dr. A. Boström and Dr. A. El-Bahrawy, Chalmers University of Technology, Division of

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APPENDIX:

Matrices expressions:

$$DSn_{TS} = \begin{bmatrix} Gn_1^1 & Gn_1^2 & Gn_1^3 & \dots & Gn_1^{M-1} & Gn_1^M \\ Gn_2^1 & Gn_2^2 & Gn_2^3 & \dots & Gn_2^{M-1} & Gn_2^M \\ Gn_3^1 & Gn_3^2 & Gn_3^3 & \dots & Gn_3^{M-1} & Gn_3^M \\ \dots & \dots & \dots & \dots & \dots & \dots \\ Gn_{N-1}^1 & Gn_{N-1}^2 & Gn_{N-1}^3 & \dots & Gn_{N-1}^{M-1} & Gn_{N-1}^M \\ Gn_N^1 & Gn_N^2 & Gn_N^3 & \dots & Gn_N^{M-1} & Gn_N^M \end{bmatrix} \quad (Nx3M) \quad (A1)$$

$$S22'_{TS} = \begin{bmatrix} s_{22^1}^1 & s_{22^1}^2 & s_{22^1}^3 & s_{22^1}^4 & s_{22^1}^5 & \dots & s_{22^1}^{M-2} & s_{22^1}^{M-1} & s_{22^1}^M \\ s_{22^2}^1 & s_{22^2}^2 & s_{22^2}^3 & s_{22^2}^4 & s_{22^2}^5 & \dots & s_{22^2}^{M-2} & s_{22^2}^{M-1} & s_{22^2}^M \\ s_{22^3}^1 & s_{22^3}^2 & s_{22^3}^3 & s_{22^3}^4 & s_{22^3}^5 & \dots & s_{22^3}^{M-2} & s_{22^3}^{M-1} & s_{22^3}^M \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ s_{22^{N-2}}^1 & s_{22^{N-2}}^2 & s_{22^{N-2}}^3 & s_{22^{N-2}}^4 & s_{22^{N-2}}^5 & \dots & s_{22^{N-2}}^{M-2} & s_{22^{N-2}}^{M-1} & s_{22^{N-2}}^M \\ s_{22^{N-1}}^1 & s_{22^{N-1}}^2 & s_{22^{N-1}}^3 & s_{22^{N-1}}^4 & s_{22^{N-1}}^5 & \dots & s_{22^{N-1}}^{M-2} & s_{22^{N-1}}^{M-1} & s_{22^{N-1}}^M \\ s_{22^N}^1 & s_{22^N}^2 & s_{22^N}^3 & s_{22^N}^4 & s_{22^N}^5 & \dots & s_{22^N}^{M-2} & s_{22^N}^{M-1} & s_{22^N}^M \end{bmatrix} \quad (Nx3M) \quad (A2)$$

$$DFn_{TS} = \begin{bmatrix} g(R_{i1}^1, r_1^1) & g(R_{i1}^2, r_1^2) & g(R_{i1}^3, r_1^3) & \dots & g(R_{i1}^{M-1}, r_1^{M-1}) & g(R_{i1}^M, r_1^M) \\ g(R_{i2}^1, r_2^1) & g(R_{i2}^2, r_2^2) & g(R_{i2}^3, r_2^3) & \dots & g(R_{i2}^{M-1}, r_2^{M-1}) & g(R_{i2}^M, r_2^M) \\ g(R_{i3}^1, r_3^1) & g(R_{i3}^2, r_3^2) & g(R_{i3}^3, r_3^3) & \dots & g(R_{i3}^{M-1}, r_3^{M-1}) & g(R_{i3}^M, r_3^M) \\ g(R_{i4}^1, r_4^1) & g(R_{i4}^2, r_4^2) & g(R_{i4}^3, r_4^3) & \dots & g(R_{i4}^{M-1}, r_4^{M-1}) & g(R_{i4}^M, r_4^M) \\ \dots & \dots & \dots & \dots & \dots & \dots \\ g(R_{iN}^1, r_N^1) & g(R_{iN}^2, r_N^2) & g(R_{iN}^3, r_N^3) & \dots & g(R_{iN}^{M-1}, r_N^{M-1}) & g(R_{iN}^M, r_N^M) \end{bmatrix} \quad (NxM) \quad (A3)$$

where

$$g(R_{in}^m, r_n^m) = \frac{1}{\rho \omega^2} \left[\left(\frac{1}{r_n^m} i k_f R_{2n}^m e^{i k_f r_n^m} - \frac{e^{i k_f r_n^m}}{(r_n^m)^2} R_{2n}^m \right) n_2 + \left(\frac{1}{r_n^m} i k_f R_{1n}^m e^{i k_f r_n^m} - \frac{e^{i k_f r_n^m}}{(r_n^m)^2} R_{1n}^m \right) n_1 \right],$$

$R_{in}^m = (x_{in}^m - y_{in}^m) / r_n^m$ and i take values 1, 2, and 3, except an imaginary quantity.

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